

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Technical workshop on the conservation of sea cucumbers
in the families Holothuridae and Stichopodidae
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SEA CUCUMBER POPULATION STATUS, FISHERIES
AND TRADE IN THE UNITED STATES

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1. Information on wild populations

A) Tropical

i) Western Atlantic

There are seven sea cucumbers of potential commercial value in the waters surrounding Florida, Puerto Rico and the U.S. Virgin Islands (*Astichopus multifidus*, *Actinopygia agassizii*, *Isostichopus badionotus*, *Eostichopus amesonii*, *Holothuria mexicana*, *H. thomasa*, and *H. impatiens*). These occur in mangrove, grassbed, coral reef and sandy or silty environments. All species are most common from about 1 m to 10 m depth, except *A. multifidus* which is most common from 5-40 m depth. These species generally occur at densities of up to 1-2 animals per 10 m². Higher densities are occasionally observed for some species. For instance, *I. badionotus* has been reported in sandflats at densities of 1 individual per 7-8 m².

ii) Pacific

A high diversity of sea cucumbers have been identified in the U.S. territories of Guam (30 species), CNMI, and American Samoa, and in the U.S. Freely Associated States (28 species), including 16 of commercial importance (Richmond, 1996). Fewer species occur in Hawaii. Most of the species that occur in the U.S. Pacific territories overlap with those found throughout southeast Asia and the south Pacific.

The primary commercial species in the U.S. Pacific has been *Actinopygia mauritiana*, which inhabits the surge zone of fringing and barrier reefs. It occurs to about 10 m depth, with the highest densities at about 2 m. In Saipan, Northern Marianas, it is reported at densities of 1-6 animals per 100 m² on the reef flat and 0.1-1.3/100m² on the reef slope. This species attains sexual maturity at about 22 cm, or 2-3 years in age, with a lifespan of about 12 years.

B) Temperate

i) Northeastern Pacific

There are 14 species of sea cucumbers found in the Pacific northwest. Two of these are commercially important, *Parastichopus californicus* (giant red sea cucumber) and *P. parvimensis* (warty sea cucumber). They are both epibenthic detritivores (deposit feeders) that consume organic detritus and small organisms within sediments and mud. These species are broadcast spawners, with separate sexes and a sex ratio of close to 1:1. Spawning occurs in late spring and summer (May to August), typically in shallow water (<16 m); they undergo visceral atrophy each year after spawning. Recruitment is sporadic and adults have a relatively high natural mortality. The primary predators are the sea stars, *Pycnopodia* and *Solaster*. Because of their life history traits, they are thought to have a low maximum yield per recruit and are particularly vulnerable to overfishing (Rogers-Bennett and Ono, 2001).

Parastichopus californicus occurs from Baja California (Cedros Island) to the Gulf of Alaska, from the lower intertidal to about 250 m. It is widely distributed throughout a variety of habitats (mud, gravel, rock rubble and solid bedrock) and environments (exposed coastal areas to sheltered inlets), with the greatest density in areas with accumulations of high organic sediments. Animals are slow growing (5-20 mm at 1 yr; maximum size of 50 cm), and reach sexual maturity at 4-8 years; the lifespan is about 8-12 years (Cameron and Frankboner, 1989).

Parastichopus parvimensis is most common from Baja California (Mexico) to Monterey Bay, California, but occurs at lower abundances as far north as Point Conception. It is found from the intertidal to about 30 m depth in areas with little water movement. This species is smaller than *P. californicus*, with a maximum length of 30-40 cm.

A limited number of field surveys have been conducted to evaluate the status of *P. californicus* populations, with information used to manage commercial fisheries. In California, these species have a patchy distribution on rocky or sandy substrates, and do not appear to form seasonal, spawning or feeding aggregations. Population surveys have been monitored in the Channel Islands and Santa Barbara Islands since 1982. Between 1990-1994 the average density at all the monitored sites has declined but populations have been at about the same levels as in the 1980s for the last several years. However, populations at fished sites were 50-80% lower than at non-fished sites. For instance, at an established reserve in northern California (Cabrillo Reserve, 40-60 m) densities averaged around 1,000 per acre. Densities at a newly established reserve (Punta Gorda Ecological Reserve) ranged from 120 to 350 per acre, with only the large size classes observed surveys (Rogers-Bennett and Ono, 2001).

Oregon Department of Fish and Wildlife (ODFW) submersible surveys off southern Oregon found densities of cucumbers of 0.1 - 0.22/m² in 44 - 71 fathoms. Densities were less at shallower depths. Commercial densities in British Columbia are estimated at less than 0.25/m². However, at depths greater than 1300-1600 fathoms, sea cucumbers are the most numerous animal found.

ii) North Atlantic

There are four species of sea cucumbers found off the Northwestern Atlantic. Only one of these, *Cucumaria frondosa* (orange footed cucumber; pumpkins; great northern cucumber) is commercially important. *C. frondosa* ranges throughout North Atlantic and Arctic Oceans, including the Norwegian, Barents and North Sea and the waters around Iceland. Its southern range along the northwestern Atlantic is Cape Cod and Nantucket, Massachusetts. It is distributed from the intertidal to over 300 m depth, with the highest abundance from 30-60 m. It inhabits a variety of substrates, including gravel, shell rocks, mud, with the densest populations found in rocky areas.

This species is a suspension (filter) feeder, consuming phytoplankton and organic detritus. It is slow growing, reaching a maximum size of 20 cm in inshore areas and 50 cm in deeper offshore waters. Sexes are separate and animals reach sexual maturity at 2.5-3 years, when about 3.5 cm in length. Spawning occurs between March and August. Animals grow to 12 cm within 5.5 years, and have an estimated lifespan of 10 years (Chenoweth and McGowan, 2004).

In Maine, population densities can reach 5 individuals/m² and populations can comprise up to 50% of the benthic biomass. Dive surveys using transects demonstrate the patchy nature of the species, with abundances ranging from 0.01 to 7.45 animals per square meter, with substantial differences in size and weight of animals between sites.

2. Nature of Sea Cucumber Fisheries

In the United States, sea cucumber fisheries can be separated into: 1) those occurring in state waters, each of which is managed by individual states; and 2) those located in the EEZ (3-200 miles off the U.S. mainland and surrounding Hawaii and the Caribbean and Pacific territories), which are managed by NOAA Fisheries in coordination with Regional Fishery Management Councils.

There is no reported sea cucumber farming in the United States.

A) Tropical Fisheries

i) Pacific

An intermittent fishery for holothurians in the Commonwealth of the Northern Marianas Islands (CNMI) dates back to the 1930s, primarily for export to Japan. In 1941, total catch on Saipan was 54,284 kg. A small commercial fishery for *A. mauritiana* and *H. whitmaei* was reopened for the first time in 1995, but was halted in early 1997 due to declining CPUE (Trianni, 2003). From October 1995-May 1997 the total catch was 268,068 animals (76 metric tons), most from Saipan and Rota, primarily for export to Taiwan and Hong Kong. One species (*H. atra*) is currently harvested on a subsistence level (Green, 1997).

In American Samoa, a small sea cucumber fishery targets the internal organs, which are bottled, fermented and marketed locally as “sea”. The animals are returned after they

eviscerate to allow for regeneration of the organs. There are no official records of sea cucumber exports, although occasional exports are thought to occur via foreign fishing vessels which visit American Samoa (T. Beeching, pers. Comm.).

In Guam, *Stichopus horrens* and *Holothuria atra* are harvested sporadically, at levels much less than in the 1800s, when catch of 2-3 tons were documented (Green, 1997). There is currently no active commercial fishery, although certain public access areas experience subsistence collection by Micronesians.

In State waters of Hawaii a low amount of commercial harvest of sea cucumbers (“lolo”) occurs (Table 1).

Table 1. Annual reported landings for the state of Hawaii. Source: Hawaii Division of Aquatic Resources reported landings tables, 1984-2003. Available on line at http://wpacfin.nmfs.hawaii.edu/hi/dar/Pages/hi_data_1.htm

Year	Landings	Total value (USD\$)	Price per kg
2003	130.6	\$929	\$1.47
2002	102.1	\$699	1.61
2001	54.0	\$333	1.28
2000	113.4	\$811	2.38
1999	51.3	\$867	3.64
1998	52.6	\$920	3.60
1997	50.3	\$792	3.24
1996	53.1	\$534	2.10
1995	23.1	\$462	4.11
1994	28.6	\$443	3.19

A Federal grant program funded a five-year project in several Pacific Islands [American Samoa, Guam, and Federated States of Micronesia (FSM)] on resource surveys, aquaculture and management with emphasis on three species, *H. nobilis*, *A. mauritiana* and *H. atra*. The project resulted in a general moratorium on export harvests in Palau and portions of the FSM, and the development of a generic sea cucumber Management Plan for Micronesian states (Richmond, 1996).

ii) Atlantic

Sea cucumbers (*Holothuria* spp.) are included in the fishery management unit (FMU) of the Fishery Management Plan for Corals and Reef Associated Plants and Invertebrates of Puerto Rico and the U.S. Virgin Islands. However, there is no known harvest in federal waters of the U.S. Caribbean.

B) Temperate Fisheries

Temperate North American sea cucumber fisheries are based on one or two species in each location. *Parastichopus californicus* is the primary target on the west coast, with limited take of *P. parvimensis*, while the east coast fishery is based on *Cucumaria frondosa*. According to FAO statistics, the total capture fisheries production for the U.S.

over the last 10 years (1992-2001) is 18,127 metric tons with a maximum production of 4,583 mt in 2000 (Table 5).

i) California

The California fishery started in 1978 and is based on *P. californicus* and *P. parvimensis*. It is both a dive and trawl fishery, with most trawling concentrated in southern California and diving in northern California. Until 1997 an average of 75% of the annual catch was from the southern California trawl fishery; this has declined in recent years, partially due to prosecution of illegal trawl fishers which reduced the total number of trawl fishermen. Beginning in 1997, divers who held sea urchin and abalone permits shifted their efforts to sea cucumbers, and the dive fishery increased substantially, accounting for 80% of the total harvest (Rogers-Bennett and Ono, 2001).

Annual landings remained under 40,000 kg until 1982, when the principal trawl areas shifted from Los Angeles area ports to the Santa Barbara Channel. Annual landings fluctuated between about 20,000-60,000 kg until 1991 when it climbed to over 261,871 kg. In 1996, combined trawl and dive harvest peaked at 380,703 kg with an ex-vessel value of USD \$582,370 (Rogers-Bennett and Ono, 2001).

Since 1992-1993, a special permit has been required for sea cucumber harvest. Permit recipients must have landed a minimum of 20 kg during the previous four year period. In 1997, separate permits were issued for each gear type, with a limit on the total number of permits issued. There are currently 113 sea cucumber dive permits and 36 trawl permits. There are no restrictions on catch.

ii) Oregon

Oregon's sea cucumber fishery began in 1993 and is based on *P. californicus*, with most collection by hand using dive gear. Harvest by trawl was also allowed, but it required an experimental gear permit (McCrae, 1994).

Oregon Department of Fish and Wildlife placed sea cucumbers within the Developmental Fisheries Program, which was developed in 1993 to allow for the controlled development of new commercial fisheries. Under the first year of the program landings were 2335 kg by 9 divers, although 44 permits were issued; 4777 kg were landed by 22 divers in 1994. Since this time very little harvest of sea cucumber has occurred in Oregon waters, with exception of 1997 (Table 2). Permits were issued until 2003, when sea cucumbers were moved to category B of the Developmental Fisheries Program species list, which include those species with less potential for a viable fishery. For 2004, sea cucumber harvest no longer requires a developmental fishery permit (McCrae, pers. Comm.).

Table 2. Kilograms of sea cucumbers landed and fishing effort in Oregon, 1995-2003.

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Kg landed	0	0	3295	0	3.28	132	15.9	0	312
Harvesters			5		2	1	2		2
Permits issued	15	3	7	9	2	7	8	4	2

iii) Washington

The Washington sea cucumber fishery is based on one managed species, *Parastichopus californicus*. Commercial harvest primarily involves the use of dive gear, with lower levels of harvest by an experimental trawl fishery. Sea cucumbers may also be collected while diving for personal use, with a daily limit of 10 animals. There are 13 nonclassified sea cucumber species in Washington State waters that are collected at low levels for research and aquariums under Washington Department of Fish and Wildlife (WDFW) Scientific Collecting permits.

The commercial dive fishery is open year round; the experimental trawl fishery is closed during soft-shell Dungeness crab (reproductive) periods and trawling is prohibited in shrimp areas. The average statewide CPUE has increased since 1996 and has reached a historic high, possibly as a result of a smaller, more efficient fleet (Table 5). There are currently 46 licensed commercial divers, with a license reduction program initiated in 2002, with the goal of a reduction of the total number of licenses to 25.

Harvest in Washington State occurs under a cooperative management agreement with treaty tribes. There are five management regions in Puget Sound, with about 50% of the total quota allocated for state harvest and 50% tribal harvest. The annual statewide harvest guideline (1997-2002) was 427,690 kg, with a total estimated available commercial biomass of 5.58 million kg. The landed product has an ex-vessel value of about USD \$1.2 million. As a precautionary approach, the 2003-2004 quota has been reduced by 15% of that calculated for 1997 until more recent biomass estimates are completed (Table 3). The quota has been developed determined using the Schaefer (1954) surplus production model based on estimates of biomass from catch-effort data, video surveys, and dive surveys (Bradbury, 1994).

Table 3. Harvest guidelines for sea cucumbers in Washington (Anonymous, 2003).

<u>Management Region</u>	<u>2003-2004 Harvestable Surplus (kg)</u>
San Juan	295,372
Strait of Juan de Fuca	70,755
Central Puget Sound (26C)	17,280
Central Puget Sound (remaining areas)	906
Hood Canal	3,084
<u>South Puget Sound</u>	<u>30,840</u>
TOTAL	372,055

Seven area closures for the dive fishery have been established in the current management plan, including two that are closed for human health reasons. Regulations on the trawl fishery include spatial closures (no trawling in water less than about 20 m depth), specific fishing locations, and restrictions on gear type and size, including maximum beam width for beam trawl gear and minimum mesh size for otter trawl gear.

Fish receiving tickets are submitted to WDFW after each fishing trip for use in determining when the annual Tribal and State commercial harvest quota is reached. Fishermen also submit monthly harvest logs that include the date, vessel name or boat

registration number, location fished, pounds landed, average depth of harvest, number of divers, and total diver hours spent fishing.

iv) Alaska

The Alaska sea cucumber fishery for *P. californicus* began in 1981 in Southeast Alaska as an experimental fishery, and in 1987 around Kodiak Island. Sea cucumbers are collected by hand using dive gear, typically at depths of 3-20 m, with no restrictions on the use of mixed gases or saturation diving. Initially most vessels were small skiffs operating as a day fishery. More recently, larger vessels with two divers and a crewman and living quarters have extended the range and duration of fishing trips.

The dive fishery in both locations was initially based only on a permit system. However, due to rapid expansion, the fishery exceeded the ability of the Alaska Department of Fish and Game to manage by a permit system. The fishery was closed in May 1990, until a management plan was written. This plan relies on a quota developed based on historic production, fisheries performance and biannual survey data of population biomass with a total harvest rate of 6%. The harvest rate is estimated to be 50% of MSY, calculated using surplus production model that incorporates 1) an estimate of virgin population size; 2) a reduction of the quota to 50% of the harvest rate derived from the model; and 3) with another 30% reduction to account for field sampling variability. In addition, there is no allowable harvest in areas with biomass estimates below a threshold of 1kg/m of shoreline (Woodby, Kruse and Larson, 1993).

The Southeast Alaska Sea Cucumber Commercial Fisheries Management plan was completed in October 1990. The management plan established 18 areas closed to fishing and annual guideline harvest levels of 6.4% of the total sea cucumber biomass taken on a 3 year rotational basis. There is also a seasonal closure (April-September), and a limit on the number of fishing days and hours per week, and trip limits for each vessel. There a progressive increase in effort to a maximum of 424 divers in 1995-1996 season. Beginning in 1996, a moratorium on the dive fishery was imposed, limiting the number of divers able to participate in the fishery to 472. There were 235 permits issued for the 2001/2002 season (Hebert and Pritchett, 2002). The quota for 2001/2002 was 646,466 kg, with an actual harvest of 652,477 kg with an estimated ex-vessel value of USD \$2,517,289 (Table 4b). For the 2002/2003 an additional 58,000 kg were added to the quota within three new collection areas.

The commercial fishery was reopened in Kodiak in 1991 under a new management plan. Current management measures include 1) a closed season from May through September to protect spawning aggregations; and 2) fifteen large harvest refugia within the managed area. In addition, sea cucumber research control sites are monitored annually to differentiate environmental effects from fishing effects. Since 1995, fishing periods have also been reduced to three days per week to allow analysis of fishing performance and monitor progress towards the established harvest guidelines (Ruccio and Jackson, 2002). Divers are licensed and must obtain a Commercial Fisheries Entry Commission interim use permit. Fish tickets are required from fishermen, operators of commercial fishing vessels, processors and buyers. In addition, completed logbooks that provide coordinates

of fishing areas must be submitted by each fishing vessel as one component of each fish ticket (Ruccio and Jackson, 2002). The number of permits has ranged from 18-86 each year, with a maximum number issued in 1986 and 18 permits issued in 2001. Annual quotas have been established for each area as guideline levels of harvest, currently amounting to 113,759 kg divided among Kodiak (90,719 kg) and Chignick (23,040 kg). Harvest in the 2000/2001 season amounted to 69,216 kg (Ruccio and Jackson, 2002). Prices have fluctuated between USD \$0.42-0.68 per kg with a total landed value in 2001 of about USD \$190,000. Starting in 2002/2003 season, an additional four areas in Kodiak district and three other areas in the Aleutian Islands were open to experimental fisheries, with a guideline harvest level of 2268 kg for each area (Ruccio and Jackson, 2002).

Table 4a. Thousands of kilograms of sea cucumbers landed, fishing effort and landed value for Kodiak Island in Alaska, 1993-2001.

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Kg landed	256.1	187.6	65.8	73.7	60	64.6	52.7	52.7	69.2
No landings	487	269	60	93	65	55	36	56	73
Permits issued	50	86	21	31	26	16	19	20	18
Value/kg (USD)	0.42	0.54	0.57	0.57	0.53	0.54	0.54	0.68	0.57

Table 4b. Total landings of sea cucumbers (thousands of kg), number of divers and ex-vessel value in millions of USD from 1986-2001 in Southeast Alaska.

Year	Kg landed	No divers	Ex-vessel Value
1986	15.44	7	0.007
1987	29.51	11	0.014
1988	363.51	57	0.169
1989	1051.58	205	0.969
1990	364.78	143	0.472
1991	394.62	187	0.697
1992	566.82	240	0.988
1993	437.42	320	0.995
1994	599.75	261	2.361
1995	604.23	424	1.846
1996	411.32	294	1.169
1997	405.85	226	1.458
1998	478.80	219	1.636
1999	711.98	200	3.06
2000	525.44	220	2.583
2001	652.48	235	2.517

v) **Maine**

The Maine sea cucumber fishery is a low value/high volume fishery that targets *C. frondosa*. The fishery began in 1988 with one operator, and expanded in 1994 when Asian markets for this species emerged. Fishermen use boats ranging from 12-30 m in length equipped with either scallop chain sweeps or light urchin drag gear. The gear is limited to 167 cm width and 7 m length and has a head bail constructed of less than 3.8 cm round steel stock. On a typical day, each boat harvests 70-200 totes of sea cucumbers. Catch per boat per day was about 7,212 kg, with an average of 16 (+/-5) tows per day. There are currently 16 endorsements, although only three are active (Feindel, 2002).

In the mid 1990s, the industry employed from 75-100 individuals that processed sea cucumbers and 15-20 fishermen, with annual harvest of 453,542-1,360,512 kg. Landings had increased to over 3.6 million kg in 1999 and over 4.08 million kg in 2000. In 2001, landings decreased to 1.27 million kg. The decline was associated with the closure of two of the three processing plants (Feindel, 2002).

There have been some problems associated with the fishery. The primary concern is that most of the fishing effort is clumped in a few sites in three locations in eastern Maine, and there are anecdotal reports that some sites have been fished out. In some areas there are substantial amounts of bycatch associated with the fishery. In general, bycatch is low in rocky areas where the species forms dense aggregations, while bycatch is much higher in muddy and gravel environments (Feindel, 2002).

To address concerns of possible depletion of the resource as interest in the fishery peaked, and to address gear conflict issues among lobster fisheries, regulations were implemented in March 2000 under the 1999 Sustainable Development of Emerging Fisheries Act. This included restrictions that limited the fishing season (closures between July 1 and Sept 31), defined gear size, and established a maximum number of endorsements, with licenses given only to individuals that had sold 100,000 kg during the previous year. Licensed fishermen are required to submit logbooks that include information on catch, time at sea, area fished and the value (Feindel, 2002).

Maine has established a small (USD\$500) Sea Cucumber Management Fund (\$6813) to research and manage the State's sea cucumber fishery and enforce laws related to sea cucumbers.

3. Domestic and International Trade

A. Exports and domestic consumption

Most of the *Parastichopus* spp. harvested in Alaska, California, Oregon and Washington are exported to Hong Kong, Chinese Taipei, mainland China and Korea. Chinese markets within the United States also purchase a portion of the sea cucumber catch. The majority are boiled, dried and salted before export, while lesser quantities are marketed as a frozen, pickled or live product. Exports of *Parastichopus* spp. are worth 0.31-0.68/kg, while the processed sea cucumbers can sell for up to \$9 per kg (wholesale).

In Maine, fishermen are paid about USD \$0.05 per unprocessed animal (\$7 per tote) of *C. frondosa*. Internal muscle bands and the dried body wall are the primary export product, currently worth about \$1.59 per kg. After harvest the animals are either loaded onto refrigerated trucks at the dock and shipped to Seattle for processing, or they are processed in Maine and shipped to mainland China, Hong Kong, South Korea, Singapore, Chinese Taipei and Japan. The peak export value of this fishery is estimated to be less than 1% of the global trade (Feindel, 2002).

The byproduct of processing from *C. frondosa* is marketed in the United States as nutritional supplement providing chondroitin (*NutriSea*), and is also sold as a treatment for arthritis for people (*ArthriSea* and *SeaCuMAX*) and pets (*Sea Jerky*) (Coast side Bio Resources, Stonington, Maine). The by product is also marketed as compost in Maine.

In American Samoa, the viscera of sea cucumbers are bottled, fermented and sold locally as a product called “sea”.

B. Imports

i) Beche-de-mer

No commercial statistics are available on U.S. sea cucumber imports for food.

The west coast of the U.S. is a trans-shipment point for sea cucumbers originating in Latin America en route to Asia.

ii) Aquarium trade

The United States imports a small volume of live sea cucumbers for the aquarium trade primarily from southeast Asia. The genus *Pseudocolochirus* is the dominant import, although several smaller species such as *Pentacta anceps* and *Colochirus robustus* are also available. One Caribbean species, *I. badionatus*, is commonly imported and also collected in U.S. waters

In Washington state, imports of live sea cucumbers is prohibited except by permit for scientific research or display under WDFW invertebrate disease control permits. There are no restrictions on import of market ready species for human consumption.

Table 5. Sea cucumber production and export. Production is in metric tons (FAO FishStat Plus v. 2.3; Hong Kong SAR import statistics).

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. Production	<0.5	481	472	2141	729	1779	-	2406	3732	4583	1804
Hong Kong imports										181.57	89.74

Table 6. Summary of available information on commercial landings of sea cucumbers in the United States in metric tons (mt), live weight. * Washington data for 1999-2001 is the total allowable quota (not landings).

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Alaska	693.5	786.7	670	485	465.8	543.4	764.6	578	721.7
Oregon	2.3	4.8	0	0	2.9	0	0.003	0.1	0.01
California	265.8	293.0	267.6	381	193	341	272		
Washington			529	237	227	208	427*	427*	427*
Maine		1451	1950	1270	453	2359	3630	4080	1270

Table 7. Controls and enforcement measures for sea cucumber fisheries in U.S. temperate waters.

Location	Licensing	Reporting	Validation
Alaska, USA	Divers registered and permitted.	Dive/harvest logbook with date, location (GPS), depth, bottom time, quantity.	Divers can only obtain permits for urchins or sea cucumbers but not both.
Washington, USA	Limited entry; 190 divers in 2000.	Logbooks with daily reporting of catch to avoid exceeding quota.	Must submit logbooks every month with data on date, depth location and amount (number and weight) collected.
Oregon, USA	Licenses issued up to 2003, with only two divers requesting a license.	Fish receiving tickets (dock ticket) required from sea cucumber dealers with fishermen's name, location, date and amount.	Cucumbers are listed under developmental fisheries species list category B. As of 2004 the fishery no longer requires a permit.
California, USA	Separate annual permits for each gear type: 113 dive permits and 36 sea cucumber trawl permits.	Dive and trawl fisheries target different species; all data lumped as sea cucumber landings.	Limit permits by requiring a minimum landing of 50 lbs during the previous year. Trawl fishery declined in 1998-1999 due to prosecution of 16 trawl fishermen that fraudulently obtained sea cucumber permits.
Maine, USA	16 endorcements (only 3 active).	Harvester Logbooks.	Limit licenses to fishermen that landed >250,000 lbs in a previous year. No incidental take allowed, only take through targeted, licensed fishery.

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